

Claims

1. An isolated polynucleic acid comprising a nucleotide sequence encoding a protein or polypeptide having the biological activity of a germacrene A synthase.
2. The isolated polynucleic acid of claim 1, wherein said nucleotide sequence encodes a protein or polypeptide with an amino acid sequence having at least 70% sequence similarity to the sequence of SEQ ID NO 7 or SEQ ID NO 8.
3. The isolated polynucleic acid of claim 2, wherein said nucleotide sequence encodes a protein or polypeptide with an amino acid sequence having at least 70% sequence similarity with the sequence of SEQ ID NO 7, between amino acid 271 and amino acid 455, or with the sequence of SEQ ID NO 8, between amino acid 291 and 477.
4. The isolated polynucleic acid of claim 1, wherein said nucleotide sequence encodes the amino acid sequenc of SEQ ID NO 7.
5. The isolated polynucleic acid of claim 1, wherein said nucleotide sequence encodes the amino acid sequence of SEQ ID NO 8.
6. The isolated polynucleic acid of claim 1, wherein said nucleotide sequence has at least 70% sequence similarity to the nucleotide sequence of SEQ ID NO 3 or SEQ ID NO 4, or the complement thereof.
7. The isolated polynucleic acid of claim 1, wherein said nucleotide sequence has at least 95% sequence similarity to the nucleotide sequence of SEQ ID NO 3 or SEQ ID NO 4, or the complement thereof.

8. The isolated polynucleic acid of claim 7, wherein said nucleotide sequence is the nucleotide sequence of SEQ ID NO 3, or the complement thereof.
9. The isolated polynucleic acid of claim 7, wherein said nucleotide sequence is the nucleotide sequence of SEQ ID NO 4, or the complement thereof.
10. A process for producing a plant with modified sesquiterpenoid synthase activity, said process comprising introducing into the genome of a plant cell a recombinant DNA which when expressed in a plant cell modifies the expression of a sesquiterpenoid synthase encoded by a polynucleic acid of any of claims 1 to 9 in said cell.
11. A process for producing a plant with reduced bitterness in some or all of its plant parts, said process comprising reducing the expression of an endogenous sesquiterpenoid synthase gene in said plant.
12. The process of claim 11, comprising
 - (a) introducing into the genome of a plant cell one or more recombinant DNAs, said recombinant DNAs comprising:
 - a DNA encoding an RNA, protein or polypeptide, which when expressed in said plant cell inhibits or reduces the expression of an endogenous sesquiterpenoid synthase in said cell, and
 - a plant-expressible promoter, whereby said DNA is in the same transcriptional unit and under the control of said plant-expressible promoter; and
 - (b) regenerating said plant from said plant cell or tissue
13. The process of claim 12, wherein said sesquiterpenoid synthase is a germacrene A synthase.

14. The process of claim 13, wherein said DNA encodes a sense or anti-sense RNA capable of inhibiting or reducing the expression of said endogenous germacrene A synthase.
15. The process of claim 14, wherein said DNA comprises a sequence having at least 70% sequence similarity to the nucleotide sequence of SEQ ID NO 3 or SEQ ID NO 4, or the complementary strand thereof.
16. A process for producing a plant with increased pest resistance, said process comprising increasing or inducing the expression of a protein of polypeptide having germacrene A synthase in said plant or having the activity of an enzyme involved in the production of sesquiterpenoid lactones from germacrene A.
17. The process of claim 16, comprising
 - (a) introducing into the genome of a plant cell or tissue a recombinant DNA comprising:
 - a DNA encoding a protein or polypeptide having germacrene A synthase activity, and
 - a plant-expressible promoter; said DNA being in the same transcriptional unit and under the control of said plant-expressible promoter; and
 - (b) regenerating said plant from said plant cell or tissue
18. The process of claim 17, wherein said DNA encodes a protein or polypeptide having at least 70% sequence similarity to the amino acid sequence of SEQ ID NO 7 or with the sequence of SEQ ID NO 8.
19. The process of claim 17, wherein said DNA comprises a sequence having at least 70% sequence similarity to the nucleotide sequence of SEQ ID NO 3 or SEQ ID NO 4.

20. The process of claim 17, wherein said DNA comprises the sequence of SEQ ID NO 3 or SEQ ID NO 4.
21. A recombinant polynucleic acid comprising
- (a) a DNA encoding an RNA or protein, which when expressed in a cell of a plant either induces, increases or decreases the expression of germacrene A synthase in said cell, and
 - (b) a plant-expressible promoter; wherein said DNA is in the same transcriptional unit and under the control of said plant expressible promoter.
22. The recombinant polynucleic acid of claim 21, wherein said DNA encodes an antisense RNA, a ribozyme or a sense RNA, which when expressed in a cell of a plant decreases the expression of an endogenous germacrene A synthase in said cell.
23. The recombinant polynucleic acid of claim 21, wherein said DNA has at least 70% sequence similarity to the nucleotide sequence of SEQ ID NO 3 or SEQ ID NO 4, or the complementary strand thereof.
24. The recombinant polynucleic acid of claim 23, wherein said polynucleic acid comprises the nucleotide sequence of SEQ ID NO 3 or SEQ ID NO 4, or part thereof.
25. The recombinant polynucleic acid of claim 21, wherein said DNA comprises
- a first nucleotide sequence having at least 70% sequence similarity to the complementary sequence of SEQ ID NO 3 or SEQ ID NO 4, or part thereof, and
 - a second nucleotide sequence having at least 70% sequence similarity to the sequence of SEQ ID NO 3 or SEQ ID NO 4, or part thereof, and optionally,

- a spacer sequence between said first and said second sequence.

26. The recombinant polynucleic acid of claim 25, wherein said first nucleotide sequence is complementary to part of said second sequence.
27. The recombinant polynucleic acid of claim 21, wherein said DNA comprises
 - a first nucleotide sequence having at least 70% sequence similarity to the sequence of SEQ ID NO 3 or SEQ ID NO 4, or part thereof, and
 - a second nucleotide sequence having at least 70% sequence similarity to the sequence of SEQ ID NO 3 or SEQ ID NO 4, or part thereof.
28. The recombinant polynucleic acid of claim 21, wherein said DNA encodes a protein or polypeptide with germacrene A synthase activity.
29. The recombinant polynucleic acid of claim 28, wherein said DAN encodes a protein or polypeptide having at least 70% sequence similarity to the sequence of SEQ ID NO 7 or SEQ ID NO 8.
30. The recombinant polynucleic acid of any one of claims 21 to 29, wherein said plant-expressible promoter is the promoter of an endogenous germacrene A synthase gene.
31. The recombinant polynucleic acid of any one of claims 21 to 29, wherein said plant-expressible promoter is a constitutive promoter.
32. The recombinant polynucleic acid of any one of claims 21 to 29, wherein said plant-expressible promoter is an inducible or a tissue-specific promoter.
33. A cell of a plant, transformed with the recombinant polynucleic acid of any one of claims 21 to 32.

34. A plant consisting essentially of the plant cells of claim 33.
35. The plant of claim 34, which is selected from the group of the genera Carum, Chichorium, Daucus, Juniperus, Chamomilla, Lactuca, Pogstemon, and Vetivera.
36. The seed of a plant of claim 35, comprising said recombinant DNA.
37. A probe which is part of a polynucleic acid sequence according to any of claims 1-9 and which hybridizes specifically with said polynucleic acid or the complement thereof.
38. A primer derived from a polynucleic acid sequence according to any of claims 1-9 and which specifically amplifies with said polynucleic acid or the complement thereof.
39. A process for producing a plant with reduced bitterness in some or all of its plant parts, said process comprising reducing the production of germacrene A or a sesquiterpenoid lactone derived from germacrene A in said plant.